Chapter 2
Clustering Obsolete Computers to Reduce E-Waste

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ABSTRACT

Personal computers contribute significantly to the growing problem of electronic waste. Every computer, when finished with, must be stored, dumped, recycled, or somehow re-used. Most are dumped, at a huge cost to health and the environment, as their owners succumb to the desire to keep up with the ever-increasing power of new computers. Supercomputers and computer clusters provide more power than ordinary desktop and laptop computers, but they too are subject to rapid obsolescence. The authors have built a cluster of obsolete computers and have found that it easily outperforms a fairly standard new desktop computer. They explore how this approach can help to mitigate e-waste, and discuss the advantages and limitations of using such a system.

INTRODUCTION

Electronic waste (e-waste) or waste electrical and electronic equipment (WEEE) is a vast and burgeoning problem in today’s society, and personal computers contribute significantly to this problem. Every computer, when finished with, must be stored, dumped, recycled, or somehow re-used. Most are dumped, at a huge cost to health and the environment, as their owners succumb to the desire to keep up with the ever-increasing power of new computers. Supercomputers and computer clusters provide even more power than ordinary desktop and laptop computers, but they too are subject to rapid obsolescence. This paper examines how clusters of obsolete computers can help to mitigate e-waste.
We propose the following hypotheses:

1. The lives of obsolete computers can be usefully prolonged by building them into a computing cluster.
2. A cluster of obsolete computers can perform at least as well as a new computer.
3. A large enough cluster of obsolete computers can perform comparably to a smaller cluster of new computers.

After discussing the problem of e-waste and the purpose of computing clusters, we explain the reasons for building a cluster from obsolete rather than new computers. We then report on the cluster we have built, on its performance, and on its advantages and limitations.

The novelty of this research is that it is proposing a new method of e-waste management. We are proposing to re-use old desktop machines for the purpose of mitigating the creation of new clusters. We are proposing that this be an ongoing process, with newer waste computers continually replacing older redundant machines.

E-WASTE

E-waste is a recent term referring to electronic goods that have been discarded or have entered a period of disuse. E-waste can include many items such as televisions, electronic audio equipment, white goods, mobile phones, and computer systems (ABS, 2006; Terazono et al., 2006). However, the definition and assessment of e-waste differ across organisations and countries. Terazono et al. (2006) observe that “there is no standard definition of e-waste, and the methods used to estimate e-waste generation are not compatible among countries”.

The component of e-waste that we address here is computers, particularly personal computers constructed out of ordinary commodity parts.

Why is E-Waste a Problem?

E-waste is increasingly becoming an issue for both developing and developed nations. E-waste has become an issue in Australia and the rest of the world, for a number of reasons including the large and growing quantity of e-waste, the methods of disposal and deconstruction of e-waste, the quantities of non-renewable resources in e-waste, the potential environmental and health effects of incorrect disposal of e-waste, and the potential for damage to the reputations of companies and countries.

There is already a large and growing quantity of e-waste in Australia and throughout the world. An Australian Bureau of Statistics report notes that e-waste is a rapidly growing source of waste in Australia, and little of it is currently recycled. “E-waste is one of the fastest growing waste types. Very little of the increasing amount of e-waste generated in Australia is being recycled, with most of it ending up in landfill” (ABS, 2006).

The Australian Bureau of Statistics found in 2006 that Australians purchase 2.4 million personal computers each year (ABS, 2006). Presumably almost as many computers are made obsolete each year, and this is a growing problem: “It is estimated that there are currently around nine million computers, five million printers and two million scanners in households and businesses across Australia... E-waste in Australia is growing at over three times the rate of general municipal waste” (ABS, 2006).

There are numerous metals and chemicals used in the production of electronic goods, some of which can cause serious health and environmental consequences. E-waste, and particularly computer waste, is both valuable and hazardous. Personal computers contain a large variety of materials including toxic and valuable metals: “A typical PC consists of 23 percent plastic, 32 percent ferrous metals, 18 percent nonferrous metals, and 12 percent electronic boards (gold, palladium,